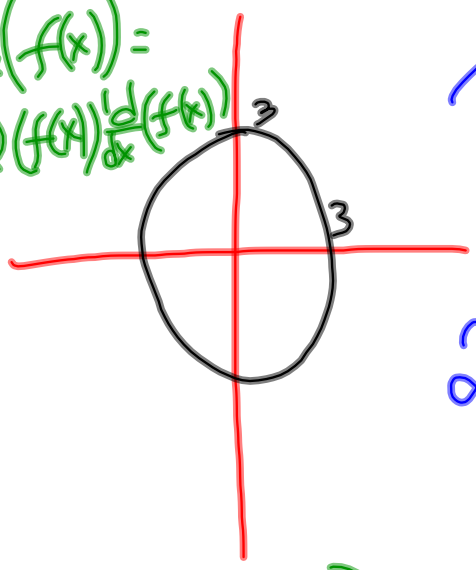
2014-10-27 day 43

3.6 What is implicit differentiation?
3.7 How to use implicit differentiation to get an equation of *rates of change?*

Take a look at $x^2+y^2=9$ (a circle of radius 3)

$\frac{d}{dx}(f(x))^2 =$
$2(f(x))\frac{d}{dx}(f(x))$



differentiating implicitly (w. respect to x) . . .

$2x+2y\frac{dy}{dx}=0$, so

$\frac{dy}{dx}=\frac{-2x}{2y}=-\frac{x}{y}$

Contrast . . . .

$x^2+y^2=9$

$y^2=9-x^2$ → $y=\sqrt{9-x^2}$, ummm,

or $y=-\sqrt{9-x^2}$

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2014-10-27 day 43

3.5/39) $y = \dfrac{(2x+3)^3}{(4x^2-1)^8}$

$21_{\text{base }19} = 2\cdot 19^1 + 1\cdot 19^0$

$100_{\text{base }19} = 1\cdot 19 + 0\cdot 19 + 0\cdot 19^0$

$$\frac{3(2x+3)^2\cdot 2\cdot(4x^2-1)^8 - (2x+3)^3\cdot 8(4x^2-1)^7\cdot 4\cdot 2x}{(4x^2-1)^{16}}$$

$$\frac{(2x+3)^2(4x^2-1)^7\left[6(4x^2-1) - 64x(2x+3)\right]}{(4x^2-1)^{16}}$$

$$= \frac{(2x+3)^2\left[24x^2-6-128x^2-192x\right]}{(4x^2-1)^9}$$

Important directives
reduce fract
factor/reduce as you go along !
imp considerations
factoring here

2014-10-27 day 43

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$y - y_0 = m(x - x_0)$

slope: m

pt: (x_0, y_0)

2014-10-27 day 43

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3.6/5) $y = x^3 (5x^2+1)^{-2/3}$ ← TIMES

3.6/5 $y' = f'g + fg' = \frac{d}{dx}(x^3)\cdot(5x^2+1)^{-2/3} + x^2\frac{d}{dx}(5x+1)^{-2/3}$

$= 3x^2(5x^2+1)^{-2/3} + x^2\left(-\frac{2}{3}(5x^2+1)^{-5/3}\cdot\frac{d}{dx}(5x^2+1)\right)$

$= 3x^2(5x^2+1)^{-2/3} - \frac{10}{3}x^3(5x^2+1)^{-5/3}$ [you could stop...]

$= \frac{3x^2(5x^2+1) - \frac{10}{3}x^3}{(5x+1)^{5/3}} = \frac{15x^4+3x^2-\frac{10}{3}x^3}{(5x+1)^{5/3}}$

= Simplify by yourself!